DRAFT REPORT

PROGRAMMATIC RISK-BASED PRELIMINARY REMEDIATION GOALS FOR THE SAND AND GRAVEL MINING LAND USE EXPOSURE SCENARIO

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

U.S. DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden, Colorado

ENVIRONMENTAL RESTORATION PROGRAM
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LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirements
BRA	baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CDPHE	Colorado Department of Public Health and Environment
CMS/FS	Corrective Measures Study/Feasibility Study
DOE	U.S Department of Energy
ECAO	Environmental Criteria and Assessment Office
EPA	U S Environmental Protection Agency
HEAST	Health Effects Assessment Summary Table
HHRA	human health risk assessment
HI	hazard index
IAG	Interagency Agreement
IRIS	Integrated Risk Information System
ORD	Office of Research and Development
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
ppm	parts per million
PPRG	Programmatic Risk-Based Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RFETS	Rocky Flats Environmental Technology Site
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SF	slope factor
TAL	target analyte list
TCL	target compound list
VOC	volatile organic compound
WAI	Western Aggregates, Inc.

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1.0 INTRODUCTION

This report addresses the development of programmatic risk-based preliminary remediation goals (PPRGs) for the sand and gravel mining land use exposure scenario at the Rocky Flats Environmental Technology Site (RFETS) The mining exposure scenario is considered in addition to those identified in *Programmatic Risk-Based Preliminary Remediation Goals, Final Revision 1* (DOE, 1994a) As a result, this report is an addendum to and not intended to replace this cited Department of Energy (DOE) report The PPRGs discussed herein, as those in DOE (1994a), are contaminant- and medium-specific concentrations intended to support evaluations of human health risk and the assessment of remedial action alternatives

1.1 Purpose

Based upon review of current and future mining opportunities for land around RFETS boundaries, it was determined that sand and gravel mining is a plausible land use and PPRGs development for the mining exposure scenario was necessary The purpose of this report is to present the methodology for the development of PPRGs for this scenario at RFETS and the resulting PPRG values DOE has developed PPRGs for RFETS for the following exposure scenarios residential land use, commercial/industrial (office worker scenario and construction worker scenario) land use, and ecological researcher use. For these exposure scenarios, PPRGs were developed for surface soil, subsurface soil, groundwater, and surface water (DOE, 1994a).

This report and the PPRGs contained herein supplement previous DOE efforts to develop PPRGs for RFETS

1.2 Scope

This report addresses the development of PPRGs which are contaminant- and medium-specific concentrations Only the PPRGs for the sand and gravel mining land use exposure scenario are developed in this report. These PPRGs are intended to support evaluations of human health risk and to assess remedial action alternatives. The PPRGs presented in this report are established

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for a lifetime additional cancer risk of 1 0E-06 (one in one million) and a hazard index (HI) of 1 0 This does not imply that acceptable risk levels for the RFETS have been established PPRGs for other target risk levels and HQs can be derived through simple linear interpolation. For example, a PPRG for a cancer excess lifetime risk of 1 0E-05 (one in 100 thousand) is ten times the 1 0E-06 PPRG

1.3 Background

Mining of sand and gravel for both private and public uses has been underway inside the western edge of the RFETS buffer zone since the early 1900s (DOE, 1994b) This mining has been sanctioned through permits Since 1990, Western Aggregates, Inc (WAI) has operated a mine and a processing plant in the RFETS buffer zone Currently permitted reserves of the mine will be processed in 15 years with the plants' current configuration Recently, WAI submitted a permit application to mine sand and gravel in two additional locations in the RFETS buffer zone (DOE 1994b) These reserves potentially represent another 10 years of mining operations A sand and gravel mining land use exposure scenario at RFETS is being considered for the assessment of potential impacts to a human receptor because of this permit application

Mining operations at these sites extract and process sand and gravel The capabilities of the processing plant include crushing, screening, and washing to remove clay Further detail of the mining process is presented in Section 2 0

The environmental medium included for PPRG development is subsurface soil The exposure pathways to workers at sand and gravel mining facilities at RFETS are·

- Ingestion of soil during extraction and processing
- Inhalation of fugitive dust generated during extraction and processing
- Inhalation of volatile organic compounds (VOCs) volatilized from subsurface soil during extraction
- Direct irradiation from radionuclides contained in the soil.

1.4 Report Organization

This introduction presented the purpose, scope, and background of this report. Section 2 0, Approach to Mining Exposure Scenario PPRGs, identifies the variable values and presents the assumptions and equations employed to derive the PPRGs used to evaluate mining worker risk Section 3 0, Chemical-Specific Information, provides specific toxicity values and chemical and physical properties used to calculate PPRGs The PPRGs for the mining exposure scenario are presented in tables in Section 4 0, followed by the references in Section 5 0

2.0 DEVELOPMENT OF PPRGS

This section identifies the variable values and presents the assumptions and equations used to calculate the PPRGs for the sand and gravel mining land use exposure scenario. Except where appropriate site-specific mining parameters are available, the U S Environmental Protection Agency (EPA) guidance cited in *Programmatic Risk-Based Preliminary Remediation Goals, Final Revision 1* (DOE, 1994a) are used to derive the risk-based equations and exposure parameters to calculate the PPRGs for the mining land use exposure scenario

2.1 Parameters for PPRG Equations

Parameters for equations to calculate mining exposure scenario PPRGs are derived from two main sources site-specific mining processes and EPA published material Each of these sources are described in the following subsections

2.1.1 Mining Process Sources

General mining operation processes include the movement of the surface soil, extraction and processing of subsurface soil, and restoration of approximately a 10-acre site each year The top 12 inches of surface soil is scraped using three mechanical scrapers This process takes approximately three days For the remainder of the year, the subsurface sand and gravel is removed within the 10-acre area. The saturation zone of the mining site is not accessed because the sand and gravel from this zone does not process well

After a year of extraction of the sand and gravel from the 10-acre area, this area is restored by filling the mining pit, covering the area with the 12 inches of surface soil scraped from the next 10-acre extraction area, and seeding and planting tree seedlings A further explanation of geological and mining studies relevant to RFETS is available in *Mining Exposure Scenario for Baseline Risk Assessments at the Rocky Flats Environmental Technology Site* (DOE, 1994b)

In their currently permitted mining location, WAI operates a mining crew of five to six employees and a collocated processing plant crew of 13 employees The mining crew is made up of two truck drivers, one backhoe operator, one bulldozer operator and one reliever These crews typically operate 10 to 12 hours/day, one shift/day, 12 months per year. The average number of days per year worked is 250 days (Meyers, 1994), of which, only 247 days are possible exposure to subsurface soil chemicals The estimated employee turnover rate for WAI is one to two persons/year

2.1.2 Published Material Sources

As in the *Programmatic Risk-Based Preliminary Remediation Goals, Final Revision 1* (DOE, 1994a), all Target Analyte List (TAL), Target Compound List (TCL) organics and 12 radionuclides have PPRGs derived for the sand and gravel mining land use exposure scenario for subsurface soil exposure

EPA recommends standard default parameters in several published guidance documents (EPA, 1989a, 1990, 1991a, 1994a,b,c,d,e) These values are used in the equations to calculate the mining land use exposure scenario PPRGs where appropriate Included are an adult body weight of 70 kilograms (kg), 70-year averaging time for carcinogens and 25-year averaging time for noncarcinogens, exposure duration of 25 years (EPA, 1989a), and particulate emission factor of 4 6E+09 m^3/kg (EPA 1991b) Because the mining crew typically do not perform strenuous activities during the mining operations, the parameter of daily inhalation rate is a combination of that for a resting and active adult (0 83 m^3/hour, EPA, 1990) The mining crew work in an enclosed cab of the machinery to perform the mining operations. Therefore, a workday soil ingestion rate of 75 milligram (mg)/day based on a 12-hour work day (EPA, 1991a), has been chosen for the calculation of the mining land use exposure scenario PPRGs

2.2 Mining Land Use Exposure Scenario Assumptions

It is assumed that the only medium for which mining personnel have significant exposure is subsurface soils The mining operations extract subsurface soils. The mining personnel are

assumed to be exposed to the surface soils for only three days per year during the scraping process This three-day exposure period is a non-chronic exposure. For the purpose of deriving PPRGs for the mining land use exposure scenario, only chronic exposure will be assessed Therefore, PPRGs for acute exposure to surface soils are not derived

For the remaining 247 working days per year, the mining workers are exposed to subsurface soils Using the EPA default value for commercial/industrial worker, worker exposure is assumed to continue for 25 years

2.3 Mining Land Use Exposure Scenario Equations

The risk-based equations for mining workers include the following exposure pathways

- Ingestion of soil during extraction and processing
- Inhalation of fugitive dust particulates generated during extraction and processing
- Inhalation of VOCs volatilized from subsurface soil while mining workers are extracting
- Direct irradiation from radionuclides contained in the soil

Inhalation of particulates does not apply to VOCs (i e., Henry's Law Constant greater than 1 0E-05 atm-m^3/mole and a molecular weight less than 200 g/mole) (EPA, 1989a)

The PPRGs derived and presented in *Programmatic Risk-Based Preliminary Remediation Goals, Final Revision 1* (DOE, 1994a) were not developed with the incorporation of the dermal exposure route, only the oral, inhalation, and external irradiation exposure are considered Mining personnel work with heavy equipment in enclosed cabs and do not work in close contact with the subsurface soil. Therefore, the mining land use exposure scenario will also not incorporate the dermal exposure route.

The PPRG equations, parameter identification, parameter values, and parameter value sources for exposure of a mining worker to subsurface soils are shown in Tables 1, 2, and 3 for carcinogens, noncarcinogens, and radionuclides, respectively EPA guidance does not specify exposure assumptions specific to a mining worker receptor. However, EPA guidance for

commercial/industrial worker receptors is available and default values for parameters from these published guidance documents are used in the mining land use exposure scenario equations (EPA, 1989a, 1990, 1991a,b, 1992) Site-specific and mining processes-specific values for parameters are used where applicable.

For the pathway involving inhalation of volatiles, a volatilization factor was calculated according to EPA guidance as shown in Table 4 developed from Dinan (1992) This is consistent with the construction worker scenario in *Programmatic Risk-Based Preliminary Remediation Goals, Final Revision 1* (DOE, 1994a). The volatilization model is applicable only for the contaminants in the unsaturated soil zone. For the purposes of deriving PPRGs for the mining land use exposure scenario, it is assumed that the saturated zone of the mining site is not accessed because the sand and gravel from this zone does not process well Thus, the equation for the derivation of the volatilization factor presented in Table 4 is appropriate for the mining land use exposure scenario

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Table 1 Equation, Parameters, and Parameter Sources for Calculating Carcinogenic Subsurface Soil Mining Exposure Scenario PPRGs

$$PPRG_1 = \frac{TR \times BW \times AT \times 365\ days/year}{EF \times ED \times \left[(SFi \times IRa \times (\frac{1}{PEF} + \frac{1}{VF})) + (SFo \times 10^{-6}\ kg/mg \times IRs) \right]}$$

where

Variable	Explanation (Units)	Parameter	Source of Parameter
$PPRG_1$	PPRG for subsurface soil based on mining worker (mg/kg)	-	
TR	target excess lifetime cancer risk (unitless)	1 0E-06	EPA, 1989a
BW	adult body weight (kg)	70 kg	EPA, 1989a, EPA default value for adults
AT	averaging time (years)	70 years	EPA, 1989a, EPA default value
EF	exposure frequency (days/years)	247 days/year	Meyers, 1994, site-specific value
ED	exposure duration (years)	25 years	EPA, 1989a, EPA default value for commercial/industrial workers
SFi	inhalation cancer slope factor (mg/kg-day)$^{-1}$	chemical-specific	EPA, 1994a,b,c,d,e
IRa	workday inhalation rate (m^3/day)	10 m^3/day	EPA, 1990, based on a EPA default total inhalation rate of 0 83 m^3/day for adults adjusted for a 12-hour workday
PEF	particulate emission factor (m^3/kg)	4 6E+09 m^3/kg	EPA, 1991b, EPA default value
VF	soil-to-air volatilization factor (m^3/kg)	chemical-specific	EPA, 1992, calculated via Table 7 equation
SFo	oral cancer slope factor (mg/kg-day)$^{-1}$	chemical-specific	EPA, 1994a,b,c,d,e
IRs	workday soil ingestion rate (mg/day)	75 mg/day	EPA, 1991a, EPA default value for adults, 75th percentile, adjusted for 12-hour work day

Table 2 Equation, Parameters, and Parameter Sources for Calculating Noncarcinogenic Subsurface Soil Mining Exposure Scenario PPRGs

$$PPRG_2 = \frac{THI \times BW \times AT \times 365\ days/year}{EF \times ED \times \left[\left(IRa \times \frac{1}{RfDi} \times \left(\frac{1}{PEF} + \frac{1}{VF} \right) \right) + \left(\frac{1}{RfDo} \times 10^{-6}\ kg/mg \times IRs \right) \right]}$$

where

Variable	Explanation (Units)	Parameter	Source of Parameter
$PPRG_2$	PPRG for subsurface soil based on mining worker (mg/kg)	-	
THI	target hazard index (unitless)	1	EPA, 1989a
BW	adult body weight (kg)	70 kg	EPA, 1989a, EPA default value for adults
AT	averaging time (years)	25 years	EPA, 1989a, EPA default value
EF	exposure frequency (days/years)	247 days/year	Meyers, 1994, site-specific value
ED	exposure duration (years)	25 years	EPA, 1989a, EPA default value for commercial/industrial workers
IRa	workday inhalation rate (m^3/day)	10 m^3/day	EPA, 1990, based on a EPA default total inhalation rate of 0 83 m^3/day for adults adjusted for a 12-hour workday
RfDi	inhalation chronic reference dose (mg/kg-day)	chemical-specific	EPA, 1994a,b,c,d,e
PEF	particulate emission factor (m^3/kg)	4 6E+09 m^3/kg	EPA, 1991b, EPA default value
VF	soil-to-air volatilization factor (m^3/kg)	chemical-specific	EPA, 1992, calculated via Table 7 equation
RfDo	oral chronic reference dose (mg/kg-day)	chemical-specific	EPA, 1994a,b,c,d,e
IRs	workday soil ingestion rate (mg/day)	75 mg/day	EPA, 1991a, EPA default value for adults, 75th percentile, adjusted for 12-hour work day

Table 3 Equation, Parameters, and Parameter Sources for Calculating Radionuclide Subsurface Soil Mining Exposure Scenario PPRGs

$$PPRG_3 = \frac{TR}{ED \times \left[(EF \times IRa \times SFi \times 10^3\ g/kg \times \frac{1}{PEF}) + (EF \times SFo \times 10^{-3}\ g/mg \times IRs) + (SFe \times (1 - Se) \times Te) \right]}$$

where

Variable	Explanation (Units)	Parameter	Source of Parameter
$PPRG_3$	PPRG for surface soil based on mining worker (pCi/g)		
TR	target excess lifetime cancer risk (unitless)	1 0E-06	EPA, 1989a
ED	exposure duration (years)	25 years	EPA, 1989a, EPA default value for commercial/industrial workers
EF	exposure frequency (days/years)	247 days/year	Meyers, 1994, site-specific value
IRa	workday inhalation rate (m^3/day)	10 m^3/day	EPA, 1990, based on a EPA default total inhalation rate of 0 83 m^3/day for adults adjusted for a 12-hour workday
SFi	inhalation cancer slope factor (risk/pCi)	chemical-specific	EPA, 1994a,b,c,d,e
PEF	particulate emission factor (m^3/kg)	4 6E+09 m^3/kg	EPA, 1991b, EPA default value
SFo	oral cancer slope factor (risk/pCi)	chemical-specific	EPA, 1994a,b,c,d,e
IRs	workday ingestion rate (mg/day)	75 mg/day	EPA, 1991a, EPA default value for adults, 75th percentile
SFe	external exposure slope factor (risk/year per pCi/g)	chemical-specific	EPA, 1994a,b,c,d,e
Se	gamma shielding factor (unitless)	0	EPA, 1991a, EPA default value
Te	gamma exposure factor (unitless)	0 3	Dinan, 1992, EPA default value

Table 4 Equation, Parameters, and Parameter Sources for Calculating the Subsurface Soil Volatilization Factor for Unsaturated Conditions

$$VF = \frac{\frac{(LS \times V \times DH)}{A} \times (3.14 \times \alpha \times T)^{1/2}}{2 \times D_{ei} \times P_a \times K_{as} \times 10^{-3}\ kg/mg}$$

where

$$\alpha = \frac{D_{ei} \times P_a}{P_a + \frac{(\rho_s)\ (1 - P_a)}{K_{as}}}$$

Variable	Explanation (Units)	Default Value
VF	volatilization factor (m^3/kg)	-
LS	length of side area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (cm^2)	20,250,000 cm^2
D_{ei}	effective diffusivity (cm^2/s)	$D_i \times (P_a^{3.33}/P_t^2)$ cm^2/s
P_a	air-filled soil porosity (unitless)	$P_t - \Theta ß$
P_t	total soil porosity (unitless)	$1-(ß/\rho_s)$
Θ	soil moisture content (cm^3-water/g-soil)	10% or 0.1 cm^3-water/g-soil
ß	soil bulk density (g/cm^3)	1.5 g/cm^3
ρ_s	true soil density or particle density (g/cm^3)	2.65 g/cm^3
K_{as}	soil-air partition coefficient (g-soil/cm^3-air)	(H/K_d) x 41 g-soil/cm^3-air (41 is a conversion factor)
T	exposure interval (s)	7.9E+08 s
D_i	diffusivity in air (cm^2/s)	chemical-specific
H	Henry's Law constant (atm-m^3/mole)	chemical-specific
K_d	soil-water partition coefficient (cm^3/kg)	K_{oc} x OC
K_{oc}	organic carbon partition coefficient (cm^3/kg)	chemical-specific
OC	organic carbon content of soil (fraction)	2% or 0.02

Source Dinan, J. 1992 *Changes to Equations in the Part B Guidance Note to Regional Toxic Integration Coordinators.* November.

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3.0 CHEMICAL-SPECIFIC INFORMATION

This section presents chemical-specific information necessary to calculate the mining land use exposure scenario PPRGs. This information includes toxicity values and chemical and physical properties The chemical-specific toxicity values and chemical and physical properties used for the calculation of the PPRGs for the mining land use exposure scenario are presented in Table 5. The toxicity information used to calculate the PPRGs include the SFs for evaluating carcinogenic effects and the RfDs for evaluating noncarcinogenic effects Toxicity values are obtained from the latest information available in IRIS (EPA, 1994a). If values are not available from IRIS, *Health Effects Assessment Summary Tables (HEAST) Annual Update* (EPA, 1994b) is consulted Values for polycyclic aromatic hydrocarbons (PAHs) are calculated using EPA guidance entitled *Region 8 Superfund Technical Guidance No RA-04 PAH Toxicity Values Development of Toxicity Values for PAHs to Use in Human Health Risk Assessment* (EPA, 1994e) Values for tetrachloroethene and trichloroethene are both from EPA memos from the Office of Research and Development (ORD) Environmental Criteria and Assessment Office (ECAO) (EPA, 1994c,d)

Chemical-specific chemical and physical properties presented in Table 5 include Henry's Law constant, organic carbon partition coefficient (K_{oc}), water solubility (EPA, 1986), and diffusivity (D_i) (EPA, 1988)

Table 5 COC-Specific Toxicity Values and Chemical and Physical Properties

Target Analyte List Chemical	Oral RfD (mg/kg-day)	Oral SF (mg/kg-day)[1]	Inhalation RfD (mg/kg-day)	Inhalation SF (mg/kg day)[1]	External SF (risk/yr per pCi/g)	Henry's Law Constant (atm-m³/mol)	K_{oc} (mL/g)	Water Solubility (mg/L)	Diffusivity
Acenaphthene#	6 00E-02	-	-	-	-	9 20E-05 k	4 60E+03 k	3 42E+00 k	-
Acenaphthylene#	-	-	-	-	-	1 48E-03 k	2 50E+03 k	3 93E+00 k	-
Acetone#	1 00E-01	-	-	-	-	2 06E-05 k	2 20E+00 k	1 00E+06 k	1 09E-01 l
Aldrin	3 00E-05	1 70E+01	-	1 70E+01 b	-	1 60E-05 k	9 60E+04 k	-	-
Aluminum	2 90E+00 n	-	-	-	-	-	-	-	-
Anthracene#	3 00E-01	-	-	-	-	1 02E-03 k	1 40E+04 k	4 50E-02 k	-
Antimony	4 00E-04	-	-	-	-	-	-	-	-
Aroclor-1016	7 00E-05	-	-	-	-	1 07E-03 k	5 30E+05 k	-	5 57E-02
Aroclor-1221	-	7 70E+00 c	-	-	-	1 07E-03 k	5 30E+05 k	-	5 57E-02
Aroclor-1232	-	7 70E+00 c	-	-	-	1 07E-03 k	5 30E+05 k	-	5 57E-02
Aroclor-1242	-	7 70E+00 c	-	-	-	1 07E-03 k	5 30E+05 k	-	5 57E-02
Aroclor-1248	-	7 70E+00 c	-	-	-	1 07E-03 k	5 30E+05 k	-	5 57E-02
Aroclor-1254	-	7 70E+00 c	-	-	-	1 07E-03 k	5 30E+05 k	-	5 57E-02
Aroclor-1260	-	7 70E+00 c	-	-	-	1 07E-03 k	5 30E+05 k	-	5 57E-02
Arsenic	3 00E-04	1 75E+00 g	-	1 51E+01	-	-	-	-	-
Barium	7 00E-02	-	1 43E-04 b	-	-	-	-	-	-
Benzene#	-	2 90E-02	-	2 90E-02	-	5 59E-03 k	8 30E+01 k	1 75E+03 k	9 23E-02 l
alpha-BHC	-	6 30E+00	-	6 30E+00	-	5 87E-06 k	3 80E+03 k	-	-
beta-BHC	-	1 80E+00	-	1 86E+00	-	4 47E-07 k	3 80E+03 k	-	-
delta-BHC	-	-	-	-	-	2 07E-07 k	6 60E+03 k	-	-
gamma-BHC (Lindane)	3 00E-04	1 30E+00 b	-	-	-	7 85E-06 k	1 08E+03 k	-	-
Benzo(a)anthracene	-	7 30E-01 t	-	-	-	1 16E-06 k	1 38E+06 k	-	-
Benzo(a)pyrene	-	7 30E+00	-	-	-	1 55E-06 k	5 50E+06 k	-	-
Benzo(b)fluoranthene	-	7 30E-01 t	-	-	-	1 19E-05 k	5 50E+05 k	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	5 34E-08 k	1 60E+06 k	-	-
Benzo(k)fluoranthene	-	7 30E-02 t	-	-	-	3 94E-05 k	5 50E+05 k	-	-
Benzoic acid	4 00E+00	-	-	-	-	-	-	-	-
Benzyl alcohol	3 00E-01 b	-	-	-	-	-	-	-	-
Beryllium	5 00E-03	4 30E+00	-	8 40E+00 b	-	-	-	-	-
bis(2-Chloroethoxy)methane#	-	-	-	-	-	1 70E-07	7 00E+00	-	-
bis(2-Chloroethyl)ether#	-	1 10E+00	-	1 10E+00	-	1 31E-05 k	1 39E+01 k	1 02E+04 k	-
bis(2-Chloroisopropyl)ether#	4 00E-02	7 00E-02 b	-	3 50E-02 b	-	1 13E-04 k	6 10E+01 k	1 70E+03 k	-
bis(2-Ethylhexyl)phthalate	2 00E-02	1 40E-02	-	-	-	1 00E-04	1 00E+04	-	-
Bromodichloromethane#	2 00E-02	6 20E-02	-	-	-	1 60E-03	5 30E+01	-	-
Bromoform#	2 00E-02	7 90E-03	-	3 90E-03	-	6 60E-04	9 80E+01	-	1 09E-01 l
Bromomethane#	1 40E-03	-	1 40E-03	-	-	6 24E-03	1 26E+02	-	-
4 - Bromophenyl phenyl ether	-	-	-	-	-	-	-	-	-
2-Butanone#	6 00E-01	-	2 86E-01	-	-	-	-	-	9 49E-02 l
Butylbenzylphthalate	2 00E-01	-	-	-	-	-	-	-	-
Cadmium	5 00E-04	-	-	6 30E+00	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-
Carbon disulfide#	1 00E-01	-	-	-	-	1 23E-02 k	5 40E+01 k	2 94E+03 k	-
Carbon tetrachloride#	7 00E-04	1 30E-01	-	5 25E-02	-	2 41E-02 k	1 10E+02 k	7 57E+02 k	8 45E-02 l
Cesium	-	-	-	-	-	-	-	-	-

Table 5 COC-Specific Toxicity Values and Chemical and Physical Properties

Target Analyte List Chemical	Oral RfD (mg/kg-day)	Oral SF (mg/kg-day)[1]	Inhalation RfD (mg/kg day)	Inhalation SF (mg/kg-day)[1]	External SF (risk/yr per pCi/g)	Henry's Law Constant (atm-m^3/mol)	K_{oc} (mL/g)	Water Solubility (mg/L)	Diffusivity
alpha-Chlordane	6 00E-05 d	1 30E+00 d	-	1 30E+00 d	-	9 63E-06 k	1 40E+05 k	-	-
beta Chlordane	6 00E-05 d	1 30E+00 d	-	1 30E+00 d	-	9 63E-06 k	1 40E+05 k	-	-
gamma-Chlordane	6 00E-05 d	1 30E+00 d	-	1 30E+00 d	-	9 63E-06 k	1 40E+05 k	-	-
4 - Chloroanaline	4 00E-03	-	-	-	-	-	-	-	-
Chlorobenzene#	2 00E-02	-	5 71E-03 b	-	-	3 72E-03 k	3 30E+02 k	4 66E+02 k	7 63E-02 l
Chloroethane#	-	-	2 86E+00	-	-	8 48E-03	3 30E+01	-	1 10E-01 l
Chloroform#	1 00E-02	6 10E-03	-	8 05E-02	-	2 87E-03 k	3 10E+01 k	8 20E+03 k	9 40E-02 l
Chloromethane#	-	1 30E-02 b	-	6 30E-03 b	-	8 82E-02	-	-	1 18E-01 l
4 - Chloro -3- methylphenol	-	-	-	-	-	-	-	-	-
2 - Chloronaphthalene#	8 00E-02	-	-	-	-	-	-	-	-
2 - Chlorophenol#	5 00E-03	-	-	-	-	1 30E-05	1 50E+01	-	-
4 - Chlorophenyl phenyl ether	-	-	-	-	-	-	-	-	-
Chromium III	1 00E+00	-	-	-	-	-	-	-	-
Chromium VI	5 00E-03	-	-	4 20E+01	-	-	-	-	-
Chrysene	-	7 30E-03 i	-	-	-	1 05E-06 k	2 00E+05 k	-	-
Cobalt	6 00E-02 n	-	-	-	-	-	-	-	-
Copper	4 00E-02 b	-	-	-	-	-	-	-	-
Cyanide	2 00E-02	-	-	-	-	-	-	-	-
4,4 - DDD	-	2 40E-01	-	-	-	7 96E-06 k	7 70E+05 k	-	-
4,4 - DDE	-	3 40E-01	-	-	-	6 80E-05 k	4 40E+06 k	-	-
4,4 - DDT	5 00E-04	3 40E-01	-	3 40E-01	-	5 13E-04 k	2 43E+05 k	-	-
Dibenzo(a,h)anthracene	-	7 30E+00 i	-	-	-	7 33E-08 k	3 30E+06 k	-	-
Dibenzofuran	-	-	-	-	-	-	-	-	-
Dibromochloromethane	2 00E-02	8 40E-02	-	-	-	-	-	-	-
Di -n- butylphthalate	1 00E-01	-	-	-	-	2 82E-07 k	1 70E+05 k	-	-
1,2 - Dichlorobenzene#	9 00E-02	-	5 60E-02 b	-	-	1 93E-03 k	1 70E+03 k	1 00E+02 k	-
1,3 - Dichlorobenzene#	-	-	-	-	-	3 59E-03 k	1 70E+03 k	1 23E+02 k	-
1,4 - Dichlorobenzene#	-	2 40E-02 b	8 00E-01	-	-	2 89E-03 k	1 70E+03 k	7 90E+01 k	-
3,3 - Dichlorobenzidine	-	4 50E-01	-	-	-	8 33E-07 k	1 55E+03 k	-	-
1,1 - Dichloroethane#	1 00E-01 b	-	1 43E-01	-	-	4 31E-03 k	3 00E+01 k	5 50E+03 k	9 64E-02 l
1,2 - Dichloroethane#	-	9 10E-02	-	9 10E-02	-	9 78E-04 k	1 40E+01 k	8 52E+03 k	9 64E-02 l
1,1 - Dichloroethene#	9 00E-03	6 00E-01	-	1 75E-01	-	3 40E-02 k	6 50E+01 k	2 25E+03 k	8 39E-02 l
1,2 - Dichloroethene (total)#	9 00E-03 b	-	-	-	-	-	3 60E+01	-	8 39E-02 l
2,4 - Dichlorophenol	3 00E-03	-	-	-	-	2 75E-06 k	3 80E+02 k	-	-
1,2 - Dichloropropane#	-	6 80E-02 b	1 14E-03	- b	-	2 31E-03 k	5 10E+01 k	2 70E+03 k	-
cis -1,3 -Dichloropropene#	3 00E-04	1 80E-01 b,e	5 71E-03	1 30E-01 b,e	-	2 40E-03	2 30E+01	-	-
trans- 1,3 -Dichloropropene#	3 00E-04	1 80E-01 b,e	5 71E-03	1 30E-01 b,e	-	1 80E-03	2 60E+01	-	-
Dieldrin	5 00E-05	1 60E+01	-	1 60E+01	-	4 58E-07 k	1 70E+03 k	-	-
Diethylphthalate	8 00E-01	-	-	-	-	1 14E-06 k	1 42E+02 k	-	-
2,4 - Dimethylphenol#	2 00E-02	-	-	-	-	6 00E-07	4 25E+02	-	-
Dimethylphthalate	1 00E+01	-	-	-	-	-	-	-	-
4,6 - Dinitro -2- methylphenol	-	-	-	-	-	4 80E-11	2 25E+02	-	-
2,4 - Dinitrophenol	2 00E-03	-	-	-	-	6 45E-10 k	1 66E+01 k	-	-
2,4 - Dinitrotoluene	2 00E-03	-	-	-	-	5 09E-06 k	4 50E+01 k	-	-

Table 5 COC-Specific Toxicity Values and Chemical and Physical Properties

Target Analyte List Chemical	Oral RfD (mg/kg-day)	Oral SF (mg/kg-day)[1]	Inhalation RfD (mg/kg day)	Inhalation SF (mg/kg day)[1]	External SF (risk/yr per pCi/g)	Henry's Law Constant (atm-m^3/mol)	K_{oc} (mL/g)	Water Solubility (mg/L)	Diffusivity
2,6 - Dinitrotoluene	1 00E-03 b	6 80E-01	-	-	-	3 27E-06 k	9 20E+01 k	-	-
Di -n- octylphthalate	2 00E-02	1 40E-02	-	-	-	-	-	-	-
Endosulfan I	6 00E-03 b,f	-	-	-	-	-	-	-	-
Endosulfan II	6 00E-03 b,f	-	-	-	-	-	-	-	-
Endosulfan sulfate	6 00E-03 b,f	-	-	-	-	-	-	-	-
Endosulfan (technical)	6 00E-03 b	-	-	-	-	-	-	-	-
Endrin ketone	-	-	-	-	-	-	-	-	-
Endrin (technical)	3 00E-04	-	-	-	-	-	-	-	-
Ethylbenzene#	1 00E-01	-	2 86E-01	-	-	6 43E-03 k	1 10E+03 k	1 52E+02 k	7 07E-02 l
Fluoranthene	4 00E-02	-	-	-	-	6 46E-06 k	3 80E+04 k	-	-
Fluorene#	4 00E-02	-	-	-	-	6 42E-05 k	7 30E+03 k	1 69E+00 k	-
Heptachlor	5 00E-04	4 50E+00	-	4 50E+00	-	8 19E-04 k	1 20E+04 k	-	-
Heptachlor epoxide	1 30E-05	9 10E+00	-	9 10E+00	-	4 39E-04 k	2 20E+02 k	-	-
Hexachlorobenzene	8 00E-04	1 60E+00	-	1 60E+00	-	6 81E-04 k	3 90E+03 k	-	-
Hexachlorobutadiene	2 00E-04 b	7 80E-02	-	7 70E-02	-	4 57E+00 k	2 90E+04 k	-	-
Hexachlorocyclopentadiene	7 00E-03	-	2 00E-05 b	-	-	1 37E-02 k	4 80E+03 k	-	-
Hexachloroethane	1 00E-03	1 40E-02	-	1 40E-02	-	2 49E-03 k	2 00E+04 k	-	-
2 - Hexanone	-	-	-	-	-	3 39E-05	1 34E+02	-	-
Indeno(1,2,3-cd)pyrene	-	7 30E-01 i	-	-	-	6 86E-08 k	1 60E+06 k	-	-
Iron	-	-	-	-	-	-	-	-	-
Isophorone	2 00E-01	9 50E-04	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-
Lithium	2 00E-02 n	-	-	-	-	-	-	-	-
Magnesium	-	-	-	-	-	-	-	-	-
Manganese	5 00E-03	-	1 43E-05	-	-	-	-	-	-
Mercury	3 00E-04 b	-	8 40E-05 h	-	-	-	-	-	-
Methoxychlor	5 00E-03	-	-	-	-	-	-	-	-
Methylene chloride#	6 00E-02	7 50E-03	-	1 64E-03	-	-	4 80E+01	-	-
2 - Methylnaphthalene#	-	-	-	-	-	5 18E-04	8 50E+03	-	-
4 - Methyl -2- pentanone#	8 00E-02 b	-	2 24E-02 h	-	-	9 40E-05	1 90E+01	-	-
2 - Methylphenol	5 00E-02	-	-	-	-	-	-	-	-
4 - Methylphenol	-	-	-	-	-	-	-	-	-
Molybdenum	5 00E-03	-	-	-	-	-	-	-	-
Naphthalene#	4 00E-02 n	-	-	-	-	-	5 94E+02	-	-
Nickel	2 00E-02	-	-	-	-	-	-	-	-
2 - Nitroaniline	-	-	-	-	-	-	-	-	-
3 - Nitroaniline	-	-	-	-	-	-	-	-	-
4 - Nitroaniline	-	-	-	-	-	-	-	-	-
Nitrobenzene#	5 00E-04	-	5 60E-04 h	-	-	2 20E-05	3 60E+01 k	1 90E+03 k	-
2 - Nitrophenol	-	-	-	-	-	-	-	-	-
4 - Nitrophenol#	-	-	-	-	-	-	2 10E+01	-	-
n - Nitrosodiphenylamine#	-	4 90E-03	-	-	-	6 40E-04	1 20E+03	-	-
n - Nitrosodipropylamine	-	7 00E+00	-	-	-	6 92E-06 k	1 50E+01 k	9 90E+03 k	-
Pentachlorophenol	3 00E-02	1 20E-01	-	-	-	2 75E-06 k	5 30E+04 k	-	-

Table 5 COC-Specific Toxicity Values and Chemical and Physical Properties

Target Analyte List Chemical	Oral RfD (mg/kg-day)	Oral SF (mg/kg day)$^{-1}$	Inhalation RfD (mg/kg-day)	Inhalation SF (mg/kg-day)$^{-1}$	External SF (risk/yr per pCi/g)	Henry's Law Constant (atm-m^3/mol)	K_{oc} (mL/g)	Water Solubility (mg/L)	Diffusivity
Phenanthrene#	-	-	-	-	-	1 59E-04 k	1 40E+04 k	1 00E+00 k	-
Phenol	6 00E-01	-	-	-	-	4 54E-07 k	1 42E+01 k	-	8 92E-02 l
Potassium	-	-	-	-	-	-	-	-	-
Pyrene	3 00E-02	-	-	-	-	5 04E-06 k	3 80E+04 k	-	-
Selenium	5 00E-03	-	-	-	-	-	-	-	-
Silver	5 00E-03	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-
Strontium	6 00E-01	-	-	-	-	-	-	-	-
Styrene#	2 00E-01	-	2 86E-01	-	-	5 20E-03	2 70E+02	-	7 46E-02 l
1,1,2,2 - Tetrachloroethane#	-	2 00E-01	-	2 00E-01	-	3 81E-04 k	1 18E+02 k	2 90E+03 k	-
Tetrachloroethene#	1 00E-02	5 20E-02 j	-	2 00E-03 j	-	2 59E-02 k	3 64E+02 k	-	7 85E-02 l
Thallium	-	-	-	-	-	-	-	-	-
Tin	6 00E-01 b	-	-	-	-	-	-	-	-
Toluene	2 00E-01	-	1 14E-01	-	-	6 37E-03 k	3 00E+02 k	5 35E+02 k	8 30E-02 l
Toxaphene	-	1 10E+00	-	1 10E+00	-	4 36E-01 k	9 64E+02 k	-	-
1,2,4 - Trichlorobenzene#	1 00E-02	-	5 60E-02 h	-	-	2 31E-03 k	9 20E+03 k	3 00E+01 k	-
1,1,1 - Trichloroethane#	-	-	-	-	-	1 44E-02 k	1 52E+02 k	-	-
1,1,2 - Trichloroethane#	4 00E-03	5 70E-02	-	5 60E-02	-	1 17E-03 k	5 60E+01 k	4 50E+03 k	-
Trichloroethene#	-	1 10E-02 j	-	6 00E-03 j	-	9 10E-03 k	1 26E+02 k	1 10E+03 k	8 61E-02 l
2,4,5 - Trichlorophenol	1 00E-01	-	-	-	-	2 18E-04 k	8 90E+01 k	-	-
2,4,6 - Trichlorophenol	-	1 10E-02	-	1 00E-02	-	3 90E-06 k	2 00E+03 k	-	-
Vanadium	7 00E-03 b	-	-	-	-	-	-	-	-
Vinyl acetate	1 00E+00 b	-	5 71E-02	-	-	-	-	-	-
Vinyl chloride#	-	1 90E+00 b	-	3 00E-01 b	-	8 19E-02 k	5 70E+01 k	2 67E+03 k	1 14E-01 l
Xylene (total)#	2 00E+00	-	-	-	-	7 04E-03 k	2 40E+02 k	1 98E+02 k	7 60E-02 l
Zinc	3 00E-01	-	-	-	-	-	-	-	-
Water Quality Parameters									
Nitrate	1 60E+00	-	-	-	-	-	-	-	-
Nitrite	1 00E-01	-	-	-	-	-	-	-	-
pH	-	-	-	-	-	-	-	-	-
Sulfide	-	-	-	-	-	-	-	-	-
Ammonium	-	-	-	-	-	-	-	-	-
Bicarbonate	-	-	-	-	-	-	-	-	-
Bromide	-	-	-	-	-	-	-	-	-
Carbonate	-	-	-	-	-	-	-	-	-
Chloride	-	-	-	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	-	-	-
Fluoride	6 00E-02	-	-	-	-	-	-	-	-
Orthophosphate	-	-	-	-	-	-	-	-	-
Silica (as in Si & SiO_2)	-	-	-	-	-	-	-	-	-
Sulfate	-	-	-	-	-	-	-	-	-

Table 5 COC-Specific Toxicity Values and Chemical and Physical Properties

Target Analyte List Chemical	Oral RfD (mg/kg-day)	Oral SF (mg/kg-day) [1]	Inhalation RfD (mg/kg-day)	Inhalation SF (mg/kg-day) [1]	External SF (risk/yr per pCi/g)	Henry's Law Constant (atm-m³/mol)	K_{oc} (mL/g)	Water Solubility (mg/L)	Diffusivity
Radionuclides		(risk/pCi)		(risk/pCi)					
Americium - 241	-	2 40E-10 b	-	3 20E-08 b	4 90E-09 b	-	-	-	-
Cesium - 137+D	-	2 80E-11 b	-	1 90E-11 b	2 06E-06 b	-	-	-	-
Plutonium - 238	-	2 20E-10 b	-	3 90E-08 b	2 80E-11 b	-	-	-	-
Plutonium - 239	-	2 30E-10 b	-	3 80E-08 b	1 70E-11 b	-	-	-	-
Plutonium - 240	-	2 30E-10 b	-	3 80E-08 b	2 70E-11 b	-	-	-	-
Radium - 226+D	-	1 20E-10 b	-	3 00E-09 b	6 00E-06 b	-	-	-	-
Radium - 228+D	-	1 00E-10 b	-	6 90E-10 b	2 90E-06 b	-	-	-	-
Strontium - 89	-	3 00E-12 b	-	2 90E-12 b	4 70E-10 b	-	-	-	-
Strontium - 90+D	-	3 60E-11 b	-	6 20E-11 b	0 00E+00 b	-	-	-	-
Tritium	-	5 40E-14 b	-	7 80E-14 b	0 00E+00 b	-	-	-	-
Uranium - 233	-	1 60E-11 b	-	2 70E-08 b	4 20E-11 b	-	-	-	-
Uranium - 234	-	1 60E-11 b	-	2 60E-08 b	3 00E-11 b	-	-	-	-
Uranium - 235+D	-	1 60E-11 b	-	2 50E-08 b	2 40E-07 b	-	-	-	-
Uranium - 238+D	-	2 00E-11 b	-	2 40E-08 b	5 10E-08 b				

# = Chemicals listed are volatile (EPA 1989b)
a = All toxicity values are from IRIS, October 1994 unless otherwise noted
b = Value from HEAST, 1994
c = Values given are for PCBs
d = Values given are for chlordane
e = Values given are for 1,3 - Dichloropropene
f = Values given are for endosulfan
g = Value given for arsenic is calculated from a unit risk of 5 00E-05 (L/µg)
h = Values given for contaminants are calculated from HEAST, 1994
i = Values given for PAHs are found in EPA, 1994e
j = Values given for tetrachloroethene and trichlorethene are from EPA memos from the Office of Research and Development Environmental Criteria and Assessment Office (EPA, 1994c,d)
k = Values given are found in the Superfund Public Health Evaluation Manual, 1986
l = Values given are found in the Superfund Exposure Assessment Manual, 1988
m = Values given are from EPA, 1992
n = Values given are provisional criteria from EPA Environmental Criteria and Assessment Office (ECAO)
" + D " = Values given include radioactive decay products

4.0 PPRGS FOR THE MINING LAND USE EXPOSURE SCENARIO

This section presents the PPRGs for the mining land use exposure scenario. For each potential chemical, the calculated PPRGs for the sand and gravel mining worker exposure scenario are presented in Table 6. Table 6 also presents the subsurface volatilization factors for each potential chemical These PPRGs are pertinent to all of the OUs at RFETS should the contaminant be identified as an OU-specific chemical. However, OU-specific factors may supersede some or all of the PPRGs should these factors preclude one or more of the exposure pathways used as the basis of the risk-based equations For example, the PPRGs for the sand and gravel mining land use exposure scenario may not be appropriate for areas where the future land use will be an ecological preserve

Because of the conservativeness of the PPRG process and parameter values, several PPRGs in Table 6 are greater than one million (1 0E+06) mg/kg This value is the same as one million parts per million (ppm) This value indicates that the chemical is pure in the media and the use of such high PPRGs is questionable

Consistent with the *Programmatic Risk-Based Preliminary Remediation Goals, Final Revision 1* (DOE, 1994a), the PPRGs presented in Table 6 are not intended to be the final cleanup standards listed in the RFETS OU-specific Records of Decision (RODs). Other factors will need to be considered when establishing the final cleanup standards such as

- Background contaminant concentrations
- Results of the OU-specific baseline risk assessment (BRA)
- Technology limitations
- Analytical methods and detection limits
- Contaminant-specific Applicable or Relevant and Appropriate Requirements (ARARs)
- Cost-benefit evaluations
- Worker safety
- Ecological effects.

Table 6 Risk-Based PPRGs and Volatilization Factors for the RFETS Mining Land Use Exposure Scenario

Target Analyte List Chemical	Subsurface Soil Volatilization Factor (m^3/kg)	Mining Carcinogen Subsurface Soil PPRG (mg/kg)	Mining Noncarcinogen Subsurface Soil PPRG (mg/kg)
Acenaphthene#	-	-	8 28E+04
Acenaphthylene#	-	-	-
Acetone#	2 61E+04	-	1 38E+05
Aldrin	-	2 27E-01	4 14E+01
Aluminum	-	-	4 00E+06
Anthracene#	-	-	4 14E+05
Antimony	-	-	5 52E+02
Aroclor-1016	-	-	9 65E+01
Aroclor-1221	2 49E+06	5 02E-01	-
Aroclor-1232	-	5 02E-01	-
Aroclor-1242	-	5 02E-01	-
Aroclor-1248	-	5 02E-01	-
Aroclor-1254	-	5 02E-01	-
Aroclor-1260	-	5 02E-01	-
Arsenic	-	2 21E+00	4 14E+02
Barium	-	-	9 52E+04
Benzene#	1 05E+04	1 03E+01	-
alpha-BHC	-	6 13E-01	-
beta-BHC	-	2 15E+00	-
delta-BHC	-	-	-
gamma-BHC (Lindane)	-	2 97E+00	4 14E+02
Benzo(a)anthracene	-	5 29E+00	-
Benzo(a)pyrene	-	5 29E-01	-
Benzo(b)fluoranthene	-	5 29E+00	-
Benzo(g,h,i)perylene	-	-	-
Benzo(k)fluoranthene	-	5 29E+01	-
Benzoic acid	-	-	5 52E+06
Benzyl alcohol	-	-	4 14E+05
Beryllium	-	8 98E-01	6 90E+03
bis(2-Chloroethoxy)methane#	-	-	-
bis(2-Chloroethyl)ether#	-	3 51E+00	-
bis(2-Chloroisopropyl)ether#	-	5 52E+01	5 52E+04
bis(2-Ethylhexyl)phthalate	-	2 76E+02	2 76E+04
Bromodichloromethane#	-	6 23E+01	2 76E+04
Bromoform#	3 09E+04	2 25E+02	2 76E+04
Bromomethane#	-	-	1 93E+03
4 - Bromophenyl phenyl ether	-	-	-
2-Butanone#	-	-	8 27E+05
Butylbenzylphthalate	-	-	2 76E+05
Cadmium	-	2 13E+04	6 90E+02
Calcium	-	-	-
Carbon disulfide#	-	-	1 38E+05
Carbon tetrachloride#	5 95E+03	3 10E+00	9 65E+02
Cesium	-	-	-
alpha-Chlordane	-	2 97E+00	8 28E+01
beta-Chlordane	-	2 97E+00	8 28E+01
gamma-Chlordane	-	2 97E+00	8 28E+01
4 - Chloroaniline	-	-	5 52E+03
Chlorobenzene#	2 85E+04	-	1 59E+03
Chloroethane#	4 78E+03	-	1 42E+05
Chloroform#	8 84E+03	3 17E+00	1 38E+04
Chloromethane#	-	2 97E+02	-
4 - Chloro -3- methylphenol	-	-	-
2 - Chloronaphthalene#	-	-	1 10E+05

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Table 6 Risk-Based PPRGs and Volatilization Factors for the RFETS Mining Land Use Exposure Scenario.

Target Analyte List Chemical	Subsurface Soil Volatilization Factor (m^3/kg)	Mining Carcinogen Subsurface Soil PPRG (mg/kg)	Mining Noncarcinogen Subsurface Soil PPRG (mg/kg)
2 - Chlorophenol#	-	-	6 90E+03
4 - Chlorophenyl phenyl ether	-	-	-
Chromium III	-	-	1 38E+06
Chromium VI	-	3 19E+03	6 90E+03
Chrysene	-	5 29E+02	-
Cobalt	-	-	8 28E+04
Copper	-	-	5 52E+04
Cyanide	-	-	2 76E+04
4 4 - DDD	-	1 61E+01	-
4,4 - DDE	-	1 14E+01	-
4,4 - DDT	-	1 14E+01	6 90E+02
Dibenzo(a,h)anthracene	-	5 29E-01	-
Dibenzofuran	-	-	-
Dibromochloromethane	-	4 60E+01	2 76E+04
Di -n- butylphthalate	-	-	1 38E+05
1,2 - Dichlorobenzene#	-	-	1 24E+05
1 3 - Dichlorobenzene#	-	-	-
1 4 - Dichlorobenzene#	-	1 61E+02	3 83E+10
3,3 - Dichlorobenzidine	-	8 58E+00	-
1,1 - Dichloroethane#	6 95E+03	-	9 57E+03
1,2 - Dichloroethane#	1 01E+04	3 00E+00	-
1,1 - Dichloroethene#	3 71E+03	5 26E-01	1 24E+04
1,2 - Dichloroethene (total)#	-	-	1 24E+04
2 4 - Dichlorophenol	-	-	4 14E+03
1,2 - Dichloropropane#	-	5 68E+01	5 46E+07
cis -1,3 -Dichloropropene#	-	2 15E+01	4 14E+02
trans- 1,3 -Dichloropropene#	-	2 15E+01	4 14E+02
Dieldrin	-	2 41E-01	6 90E+01
Diethylphthalate	-	-	1 10E+06
2 4 - Dimethylphenol#	-	-	2 76E+04
Dimethylphthalate	-	-	1 38E+07
4 6 - Dinitro -2- methylphenol#	-	-	-
2 4 - Dinitrophenol	-	-	2 76E+03
2 4 - Dinitrotoluene	-	-	2 76E+03
2 6 - Dinitrotoluene	-	5 68E+00	1 38E+03
Di -n- octylphthalate	-	2 76E+02	2 76E+04
Endosulfan I	-	-	8 28E+03
Endosulfan II	-	-	8 28E+03
Endosulfan sulfate	-	-	8 28E+03
Endosulfan (technical)	-	-	8 28E+03
Endrin ketone	-	-	-
Endrin (technical)	-	-	4 14E+02
Ethylbenzene#	4 11E+04	-	6 46E+04
Fluoranthene	-	-	5 52E+04
Fluorene#	-	-	5 52E+04
Heptachlor	-	8 58E-01	6 90E+02
Heptachlor epoxide	-	4 24E-01	1 79E+01
Hexachlorobenzene	-	2 41E+00	1 10E+03
Hexachlorobutadiene	-	4 95E+01	2 76E+02
Hexachlorocyclopentadiene	-	-	9 56E+03
Hexachloroethane	-	2 76E+02	1 38E+03
2 - Hexanone	-	-	-
Indeno(1,2,3-cd)pyrene	-	5 29E+00	-
Iron	-	-	-
Isophorone	-	4 07E+03	2 76E+05

Table 6 Risk-Based PPRGs and Volatilization Factors for the RFETS Mining Land Use Exposure Scenario

Target Analyte List Chemical	Subsurface Soil Volatilization Factor (m^3/kg)	Mining Carcinogen Subsurface Soil PPRG (mg/kg)	Mining Noncarcinogen Subsurface Soil PPRG (mg/kg)
Lead	-	-	-
Lithium	-	-	2 76E+04
Magnesium	-	-	-
Manganese	-	-	6 83E+03
Mercury	-	-	4 14E+02
Methoxychlor	-	-	6 90E+03
Methylene chloride#	-	5 15E+02	8 28E+04
2 - Methylnaphthalene#	-	-	-
4 - Methyl -2- pentanone#	-	-	1 10E+05
2 - Methylphenol	-	-	6 90E+04
4 - Methylphenol	-	-	-
Molybdenum	-	-	6 90E+03
Naphthalene#	-	-	5 52E+04
Nickel	-	-	2 76E+04
2 - Nitroaniline	-	-	-
3 - Nitroaniline	-	-	-
4 - Nitroaniline	-	-	-
Nitrobenzene#	-	-	6 90E+02
2 - Nitrophenol	-	-	-
4 - Nitrophenol#	-	-	-
n - Nitrosodiphenylamine#	-	7 88E+02	-
n - Nitrosodipropylamine	-	5 52E-01	-
Pentachlorophenol	-	3 22E+01	4 14E+04
Phenanthrene#	-	-	-
Phenol	-	-	8 28E+05
Potassium	-	-	-
Pyrene	-	-	4 14E+04
Selenium	-	-	6 90E+03
Silver	-	-	6 90E+03
Sodium	-	-	-
Strontium	-	-	8 28E+05
Styrene#	2 20E+04	-	5 27E+04
1,1,2,2 - Tetrachloroethane#	-	1 93E+01	-
Tetrachloroethene#	1 11E+04	1 54E+02	1 38E+04
Thallium	-	-	-
Tin	-	-	8 28E+05
Toluene	1 99E+04	-	2 16E+04
Toxaphene	-	3 51E+00	-
1,2,4 - Trichlorobenzene#	-	-	1 38E+04
1,1,1 - Trichloroethane#	-	-	-
1,1,2 - Trichloroethane#	-	6 77E+01	5 52E+03
Trichloroethene#	1 05E+04	5 02E+01	-
2,4,5 - Trichlorophenol	-	-	1 38E+05
2,4,6 - Trichlorophenol	-	3 51E+02	-
Vanadium	-	-	9 65E+03
Vinyl acetate	-	-	1 38E+06
Vinyl chloride	1 72E+03	1 34E-01	-
Xylene (total)#	1 76E+04	-	2 76E+06
Zinc	-	-	4 14E+05
Water Quality Parameters			
Nitrate	-	-	2 21E+06
Nitrite	-	-	1 38E+05
pH	-	-	-
Sulfide	-	-	-
Ammonium	-	-	-

- Table 6 Risk-Based PPRGs and Volatilization Factors for the RFETS Mining Land Use Exposure Scenario

Target Analyte List Chemical	Subsurface Soil Volatilization Factor (m^3/kg)	Mining Carcinogen Subsurface Soil PPRG (mg/kg)	Mining Noncarcinogen Subsurface Soil PPRG (mg/kg)
Bicarbonate	-	-	-
Bromide	-	-	-
Carbonate	-	-	-
Chloride	-	-	-
Cyanide	-	-	-
Fluoride	-	-	8 28E+04
Orthophosphate	-	-	-
Silica (as in Si & SiO3)	-	-	-
Sulfate	-	-	-
Radionuclides		(pCi/g)	(pCi/g)
Americium - 241	-	6 74E+00	-
Cesium - 137	-	6 47E-02	-
Plutonium - 238	-	9 74E+00	-
Plutonium - 239	-	9 33E+00	-
Plutonium - 240	-	9 33E+00	-
Radium - 226	-	2 22E-02	-
Radium - 228	-	4 59E-02	-
Strontium - 89	-	2 03E+02	-
Strontium - 90	-	6 00E+01	-
Tritium*	-	4 00E+04	-
Uranium - 233	-	1 24E+02	-
Uranium - 234	-	1 25E+02	-
Uranium - 235	-	5 53E-01	-
Uranium - 238	-	2 55E+00	-

* Value given is in pCi/L

These PPRGs are not to be used as standardized limits to enable screening of potential remedial technologies and alternatives. As additional information is obtained through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS) and RCRA Facility Investigation/Remedial Investigation RFI/RI and Corrective Measures Study/Feasibility Study CMS/FS process, changes will be incorporated as soon as possible during the development and screening of alternatives or detailed analysis of alternatives

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